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Report No. 97-24

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THE ASSOCIATION OF LIFE STYLE FACTORS WITH MENSTRUAL SYMPTOMS IN WOMEN SERVING ABOARD U.S. NAVY SHIPS

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NHRC report 97-24 supported by the U.S. Army Medical Research and Materiel Command under the Defense Women's Health Research Program, MIPR Number OPKM6654, work unit number 6611 (DN241269), and Naval Medical Research and Development Command, Department of the Navy, under work unit 6707 (DN240554). The views expressed in this paper are those of the authors and do not reflect the official policy or position of the Department of the Navy, Department of Defense, or the U.S. Government. Approved for public release, distribution unlimited.

Summary

Background. It has been estimated that 50-85% of women in the United States currently having menstrual periods experience dysmenorrhea and other menstrual or premenstrual symptoms, and that 3.5-7 million are incapacitated for one to two days each month because of these symptoms. Previous studies examining the association of behavioral and life style factors such as obesity, cigarette smoking, alcohol consumption and exercise with menstrual symptoms have yielded inconsistent results, with some showing a positive association and others showing either no association or a negative association. Because these life style factors are all potentially modifiable, the demonstration and elucidation of their associations with menstrual symptoms represents an important avenue of research. Most previous studies of the association of life style variables with menstrual disorders have relied on small clinic- or physician-based samples of women, or small samples of college students. There have been relatively few large, population-based studies of the association of behavioral and life style variables with dysmenorrhea or other menstrual symptoms.

Methods. A cross-sectional questionnaire based survey of 2,912 women serving aboard 36 U.S. Navy ships was conducted. The association of body mass index, cigarette smoking, alcohol consumption and exercise with the prevalence of menstrual cycle disorders was studied.

Results. After adjustment for age and other potentially confounding covariates, current cigarette smoking was associated with increased risk of all menstrual symptoms and cycle disorders. Obesity, exercise and alcohol consumption did not show consistent associations with menstrual symptoms or cycle disorders.

Conclusions. Results suggested that interventions targeted at smoking cessation might be useful to reduce the prevalence of menstrual symptoms, cycle disorders and time lost from work.

Introduction

It has been estimated that 50-85% of the 15 million women in the United States currently having menstrual periods suffer to one degree or another from dysmenorrhea and other menstrual or premenstrual symptoms [1-3]. For some women, the symptoms associated with the menstrual cycle are severe enough to cause disruption to their daily activity [2, 3]. These symptoms are responsible for more lost work and school hours in women than any disease [1-3, 4]. It has been estimated that 3.5-7 million American women are incapacitated for one to two days each month because of their symptoms [1, 5].

Previous studies examining the association between behavioral and life style factors such as obesity, cigarette smoking, alcohol consumption and exercise have yielded inconsistent results. For instance, weight loss has been associated with irregular menstrual periods and amenorrhea [6, 7]. However, obesity also has been associated with amenorrhea and other alterations in the menstrual cycle such as hypermenorrhea, oligomenorrhea, anovulation, infertility, and premature menopause [8]. Tolino, *et. al.* [8] reported that obese women have reduced serum levels of FSH, increased LH, increased LH/FSH ratios, decreased levels of sex hormone binding globulin with a resultant increase in free testosterone, and hyperestrogenism due to the increased conversion of androstenedione to estrogen in fatty tissues, all of which could affect the menstrual cycle and its characteristics.

Cigarette smoking has been associated with shorter cycle length, increased dysmenorrhea, and menopause that occurs on average one to two years earlier than for nonsmokers [2, 9]. Higher alcohol consumption has been associated with increased premenstrual symptoms [10], however, others have reported no associations between either cigarette smoking or alcohol consumption and dysmenorrhea [9, 11, 12].

Exercise has been recommended for treatment of dysmenorrhea [13] and several studies have reported a beneficial effect for exercise interventions on the premenstrual syndrome and dysmenorrhea [14-16]. For example, Prior, *et. al.* [14] found that the severity of premenstrual symptoms among sedentary women was decreased after they had participated in a 6-month physical training program. Israel, *et. al.* [16] found that 12 weeks of an aerobic exercise program reduced symptoms of dysmenorrhea. Johnson, *et. al.* [17] reported that more frequent exercise was related to lower severity ratings of some menstrual symptom clusters, but the intensity of exercise was unrelated to symptoms. However, Jarrett, *et. al.* [12] reported that there were no significant differences between women with and without dysmenorrhea in exercise behavior, and other studies have associated excessive exercise with delayed menarche, lack of ovulation and the absence of menstrual periods [6, 13, 18, 19].

Because obesity, cigarette smoking, alcohol consumption and exercise are all potentially modifiable characteristics, the demonstration and elucidation of the associations of behavioral and these life style factors with menstrual symptoms represents an important avenue of research. However, most of the previous studies of the association of life style variables with menstrual disorders have relied on small clinic-based or physician-based samples of women, or small samples

of college students. There have been relatively few large, population-based studies of the association of behavioral and life style variables with dysmenorrhea or other disturbances of the menstrual cycle.

The present study was designed to overcome the lack of scope in previous studies. It examined the association of obesity, cigarette smoking, alcohol consumption and exercise with the prevalence of menstrual cycle disorders among a large population-based sample of women in the Navy who were serving aboard ship.

Methods

This study is part of the Women Aboard Navy Ships Comprehensive Health and Readiness Research Project conducted at the Naval Health Research Center in San Diego, California as part of the Defense Women's Health Research Program administered by the Naval Medical Research and Development Command and the U.S. Army Medical Research and Materiel Command, Ft. Detrick, Maryland. This epidemiologic research project utilizes several data collection methods including surveys administered aboard ship. The study is a multi-year effort with all women serving aboard ship eligible for inclusion, along with an equal number of men matched on important characteristics.

Population

All women serving aboard U.S. Navy ships were eligible for inclusion in the survey portion of the study. An equal number of men serving aboard ship matched on relevant characteristics were also eligible. The Navy Bureau of Personnel (PERS-OOW) provided a listing of all ships with women assigned aboard; this listing was verified with respective Fleet Surgeons and Force Medical Officers. A total of 74 ships with 7,944 women and 69,012 men assigned were determined to be eligible for inclusion in the study.

This report is based on the first 36 ships surveyed. These ships were surveyed based on availability as determined by the Commanding Officer and Medical Department of each ship. The ships surveyed included USS BARRY (DDG53) , USS CAMDEN (AOE2), USS CAPE COD (AD43), USS CIMARRON (AO177) , USS COMSTOCK (LSD45), USS CORONADO (AGF11), USS CURTIS WILBUR (DDG654), USS DETROIT (AOE4), USS DIXON (AS37), USS EMORY S. LAND (AS39), USS FRANK CABLE (AS40), USS GRAPPLE (ARS53), USS GRASP (ARS51), USS HOLLAND (AS32), USS JOHN YOUNG (DD973), USS KISKA (AE35), USS LASALLE (AGF3), USS L.Y. SPEAR (AS36), USS MCKEE (AS41), USS MONONGAHELA (AO178), USS MOUNT BAKER (AE34), USS MOUNT HOOD (AE29), USS MOUNT WHITNEY (LCC20), USS PLATTE (AO186), USS MOUNT RAINIER (AOE7), USS RUSHMORE (LSD47), USS SACRAMENTO (AOE1), USS SAFEGUARD (ARS50), USS SALVOR (ARS52), USS SANTA BARBARA (AE28), USS SHASTA (AE33), USS SHENANDOAH (AD44), USS SIMON LAKE (AS33), USS SUPPLY (AOE6), USS WILLAMETTE (AO180), and USS YELLOWSTONE (AD41). These 36 ships had 5,510 women and 18,443 men assigned aboard.

Survey Development

Several methods were used for the development of the U.S. Navy Shipboard Health Survey used in this study, including the following: (1) review of extant questionnaires, literature, and standard scales, (2) convening of a panel of subject matter experts, (3) elicitation of major issues from knowledgeable sources, and (4) review of Navy requirements concerning the reporting of women's health and access to health care.

A series of questionnaires developed by the Centers for Disease Control and Prevention (CDC), Department of Defense, U.S. Navy, U.S. Army, and several universities [20, 21] were reviewed and adopted for use in this study. The questionnaires developed by the CDC included the National Health Interview Survey [22], the Health Interview Survey Form HIS-1(1992) and HIS-2(1992) [23, 24], the National Ambulatory Health Care Survey for 1994, 1995, and 1996 [25], and the Youth Behavior Survey [26]. Previous questionnaires developed by the Naval Health Research Center also were reviewed, and ranged from nutrition surveys to patient care surveys. In addition, a series of scales and inventories were reviewed and selected for use. These standard scales included but were not limited to: Center for Epidemiological Studies Depression Scale (CES-D) [27], a scale which measures the current frequency of depressive symptoms, and the Quality of Life Scale [28], a four-item scale previously used in research on Navy populations.

As part of the section on women's health conditions, participants were asked to indicate whether they had experienced the following symptoms during the past 90 days: cramps or pain during their period requiring medication or time off work; bleeding between periods, excessive frequency of periods (time between periods too short); heavy periods (excessive menstrual flow); periods lasting for longer than a week; scanty menstrual flow; and irregular periods. For the first six symptoms, participants were asked if they had first noticed the condition or if it got worse since they came aboard ship.

Survey Administration

The overall administration plan included the distribution of individually identified packets with all necessary materials to each study subject. Whenever possible, study subjects were brought together in a common location aboard ship, briefed on the study, invited to volunteer and sign informed consent forms and to complete the survey while study coordinators were present. When, due to shipboard activity, it was not practical for all study subjects to remain in one area, surveys were distributed, and the participants were allowed to fill them out in work spaces. The completed surveys were collected by study staff in sealed envelopes.

Response Rates

The overall median ship response rate for the 36 ships was 63.1%, and the overall mean response rate was 52.2%. The overall median response rate for women was 66.2%. Participation rates varied by the number of women serving aboard ship. Ships with fewer than 100 women

assigned had an overall median response rate for women of 69.5% compared to ships with more than 100 women assigned, which had an overall median response rate for women of 49.9%.

Data Analysis

Body mass index defined as weight (kg)/height(m)^2 was used as an estimate of obesity. Those who had not smoked at least 100 cigarettes in their entire life and reported either not smoking any cigarettes or less than 1 cigarette per day in the past 30 days were considered nonsmokers. Women who reported smoking 1 or more cigarettes per day were considered current smokers. Nondrinkers were defined as those who reported not having any alcoholic beverages in the past 7 days, while those who reported drinking on 1 day were considered as light drinkers, on 2-4 days moderate drinkers, and on 5-7 days heavy drinkers. The number of drinks consumed in the past week was calculated by multiplying the frequency of alcohol consumption (days/week) by the average number of drinks per day. Information on exercise was obtained for a probability sample of women (N=846). Those who reported not engaging in exercise or exercising only once or twice per week were considered as light exercisers, while those who engaged in exercise 3-4 times per week were considered moderate exercisers, and those who engaged in exercise 5 or more times per week were considered heavy exercisers.

Descriptive statistics were calculated for age, race, paygrade, each behavioral and life style variable, and each symptom. Chi-square analyses were used to calculate the proportion reporting each menstrual cycle symptom by quartile of body mass index, current cigarette smoking (no/yes) alcohol frequency (none/light/moderate/heavy), and exercise (none or light/moderate/heavy). Separate logistic regression analyses were used to examine the risk of each symptom by age, race and paygrade, and by each life style and behavioral factor after adjustment for age, race and paygrade. All statistical tests were two-tailed.

Results

There were 2,912 women who completed the survey. Age ranged from 18-49 years, with a mean of 26.0 (SD=6.1). Of these women, 58% were white, 32% were black and 10% were of other racial groups (Table 1). A total of 62% of the women were in paygrades E1-E4, 33% were in paygrades E5-E9, and 5% were officers. The distributions of each of the other behavioral and life style variables and the proportion reporting the experience of each menstrual cycle symptom or disorder also is presented in Table 1. Of note is that 5.4% of the women first noticed bleeding between periods and 4.9% first noticed heavy periods while aboard ship. An additional 3.6% of the women reported that bleeding between periods became worse and 7.2% reported that their condition of having heavy periods became worse since they came aboard ship.

The proportion of women reporting each menstrual symptom or disorder by age, race, and paygrade is shown in Table 2. Younger women were more likely to report menstrual cycle symptoms and disorders. A lower proportion of white women reported menstrual cycle symptoms

and disturbances and this was significant for bleeding between periods and scanty menstrual flow ($p<0.05$). Significant differences also were observed with paygrade for almost all symptoms; a lower proportion of women who were officers reported experiencing symptoms and cycle disturbances.

The proportion of women reporting menstrual cycle symptoms or disturbances by each of the behavioral and life style covariates is shown in Table 3. Greater proportions of women who were currently cigarette smokers reported menstrual symptoms and cycle disturbances. Those who consumed alcohol more frequently reported bleeding between periods and were more likely to report scanty menstrual flow. Those in the second quartile (next to lowest) of body mass index were more likely to report having periods lasting greater than one week. Exercise was not associated with menstrual symptoms or cycle disturbances.

Results of separate logistic regression analyses examining the association of each life style and behavioral factor with menstrual symptoms after adjustment for age, race and paygrade are presented in Table 4. As compared to nonsmokers, current smokers had an increased prevalence rate of cramps or pain requiring medication or time off work (OR=1.13, CI=1.03-1.25), bleeding between periods (OR=1.22, CI=1.09-1.38), excessive frequency of periods (OR=1.33, CI=1.17-1.51), heavy periods (OR=1.17, CI=1.06-1.29), periods lasting longer than a week (OR=1.31, CI=1.16-1.48), scanty flow (OR=1.13, CI=1.01-1.29) and irregular periods (OR=1.14, CI=1.05-1.24). As compared to women in the lowest quartile of body mass, women in the second quartile had an increased prevalence rate of excessive frequency of periods and having periods lasting longer than a week, while women in the third quartile had a decreased prevalence rate of irregular periods. As compared to nondrinkers, women who consumed a high amount of alcohol had a higher prevalence rate of heavy periods. As compared to those who exercised less than twice per week, those with a high frequency of exercise were more likely to have excessive frequency of periods. Otherwise, there were no patterns of association of exercise or alcohol consumption with menstrual symptoms. Analyses using average number of drinks per week instead of frequency per week, showed similar results (data not shown). Among the covariates, age had a protective effect; older age was associated with reduced reporting of all symptoms, with significance achieved for bleeding between periods, periods lasting longer than a week, and irregular periods. As compared to women in paygrade E1-E4, those in paygrade E5-E9 were generally more likely to report symptoms while officers were less likely to report several categories of menstrual symptoms. With the exception of black women being at a decreased risk of reporting irregular periods as compared to white women, there were no significant differences according to race.

Discussion and Conclusions

Results of the present study support the detrimental effect of cigarette smoking on menstrual symptoms. Current cigarette smoking was associated with an increased prevalence rate of every menstrual symptom. This was found even after adjustment for age and paygrade, which were each independently associated with the prevalence rate of menstrual symptoms. These results are in accord with previous studies showing that cigarette smoking is associated with shorter cycle length and increased frequency of dysmenorrhea [2, 9]. In addition, this study showed that smoking was

associated with bleeding between periods and having heavy, long and irregular periods.

In the present study, body mass index was not consistently associated with menstrual symptoms or cycle disorders. This is in contrast to Tolino, *et. al.* [8], who found that women who were more obese were at increased risk of alterations in their menstrual cycle. However, the population in the present study of Navy women is relatively lean with a mean body mass index of 23.6 and a modal body mass index of 22.4. There were very few obese women. The relationship between risk of menstrual symptoms and cycle disorders may be greater in populations having a greater proportion of obese women.

In accord with other studies [9, 11, 12], the present study generally did not find significant associations between alcohol consumption and menstrual symptoms and cycle disorders. High frequency of alcohol consumption was only associated with an increased prevalence rate of heavy periods. Furthermore, neither light nor moderate alcohol consumption increased or decreased the prevalence rate of symptoms, and results were similar when number of drinks per week was examined.

In the present study, the only significant association found with exercise was that women with high frequency of exercise were at increased risk of excessive frequency of menstrual periods, which differed from studies that reported excessive exercise was associated with an absence of menstrual periods [6, 13, 18, 19]. Exercise interventions have been associated with a beneficial effect on dysmenorrhea [13-16], and more frequent exercise has been associated with less severe symptoms [17]. In contrast to the previous studies, this study did not find an association of exercise frequency with the prevalence rate (either increased or decreased) of menstrual symptoms. Among the relatively physically fit women in the Navy, the lack of observed associations may reflect the fact that three-fourths of these women exercised 3 or more times per week.

Since more than one-third of Navy women aboard ship reported irregular periods and approximately one-fourth reported heavy periods and having cramps or pain requiring medication or time off work, the experience of menstrual cycle symptoms represents an important problem. Approximately one-third of women aboard ship reported being current cigarette smokers. While symptoms and cycle disorders may improve with age, results from the present study suggest that interventions targeted at smoking cessation may help reduce the prevalence of menstrual cycle symptoms, disorders, and time lost from work in this population.

Acknowledgment

The authors extend thanks to the Fleet Surgeon, Pacific Fleet; Fleet Surgeon, Atlantic Fleet; and Force Medical Officers of AIRPAC, SUBPAC, and SURFPAC, and AIRLANT, SUBLANT, and SURFLANT for support during the planning and data collection for this study. The research could not have been performed without the extensive cooperation throughout the planning process and data collection of the commanding officers, staff medical officers, independent duty hospital corpsmen, and members of the medical and personnel departments of the participating ships. The

authors thank Mr. Rex Sanderson and Mr. Randolph Hall for data collection aboard ship and Mr. Louis L. Balazs, M.S., for assistance with analysis. Mrs. Betty Gunderson coordinated communications among the co-investigators. Mr. Ron Clapsaddle assisted with computer programming. Mrs. Evelyn Fretty assisted with data management. Thanks also to Kathleen Robison of MACC, Monterey, for project management, and staff members Teresa Barr and Marilyn Minor for report production assistance. Thanks are also due to Dr. D. Stephen Nice for guidance in conducting the study and for manuscript review and comment.

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Table 1. Demographic characteristics and menstrual symptoms for women, U.S. Navy Women Aboard Ship Study, 15 NOV 1994 - 31 DEC 1996.

Characteristics	N	Mean	SD
Age in years	2,912	26.0	6.1
Body mass index	2,740	23.6	3.1
		%	
Race	2,907		
White		58.2	
Black		31.8	
Other		10.0	
Paygrade	2,912		
Enlisted E1-E4		61.7	
Enlisted E5-E9		33.3	
Officer		5.0	
Current smoking	2,822		
No		65.5	
Yes		34.5	
Alcohol frequency	2,782		
None		51.0	
Light (1 day/wk)		19.1	
Moderate (2-4 days/wk)		25.2	
Heavy (5-7 days/wk)		4.7	
Exercise	846		
Light (<3x/week)		24.4	
Moderate (3-4x/week)		44.8	
Heavy (5-7x/week)		30.8	

Symptoms	N	%	Percent first noticed*	Percent became worse†
Cramps or pain	2,657	26.5	0.9	1.9
Bleeding between periods	2,661	15.5	5.4	3.6
Excessive frequency	2,628	11.2	3.4	3.4
Heavy periods	2,635	24.4	4.9	7.2
Periods > 1 week	2,658	14.3	3.8	3.9
Scanty flow	2,565	11.7	3.3	3.1
Irregular periods	2,762	37.3	0.0	0.0

* Symptoms first noticed aboard ship
† Symptoms got worse since aboard ship
Abbreviations: SD = Standard Deviation

Table 2. Percentage of women reporting menstrual symptoms by age, race and paygrade, N=2,912 women, U.S. Navy Women Aboard Ship Study, 15 NOV 1994 - 31 DEC 1996.

	Symptom						
	Cramps/pain	Bleeding between periods	Excessive frequency	Heavy periods	Periods ≥ 1 week	Scanty flow	Irregular periods
Age in years							
<20	33.1	14.8	12.3	25.2	18.4	14.6	41.0
20-22	31.1	18.6	13.9	27.1	18.4	15.1	44.9
23-24	22.1	18.9	13.5	23.4	15.7	12.4	40.9
25-29	26.2	17.0	9.1	24.3	12.2	15.0	34.3
30-34	21.3	10.7	8.0	19.3	8.4	9.7	27.5
35+	23.4	8.9	9.2	25.9	11.0	10.6	30.7
χ^2	25.1***	27.6***	15.3***	9.5	31.3***	10.7	48.9***
Race							
White	25.1	14.1	11.4	23.1	13.8	14.7	38.0
Black	29.1	17.7	10.3	27.1	15.0	11.4	35.2
Other	27.1	17.3	13.0	24.3	14.6	10.3	39.8
χ^2	4.6	5.9*	1.5	4.7	0.6	6.9*	2.7
Paygrade							
Enlisted, E1-E4	29.0	17.1	12.7	26.3	16.5	13.7	42.0
Enlisted, E5-E9	23.5	13.2	9.5	22.7	11.6	12.0	32.0
Officer	16.4	12.7	4.5	13.6	5.2	16.4	17.4
χ^2	16.5***	7.5*	12.4**	12.9**	20.7***	2.6	51.5***

* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$

Table 3. Proportion of women reporting each menstrual symptoms by behavioral and life style variables, U.S. Navy Women Aboard Ship Study, 15 NOV 1994 - 31 DEC 1996.

		Symptom						
	N	Cramps or pain	Bleeding between periods	Excessive frequency	Heavy periods	Periods > 1 week	Scanty flow	Irregular periods
Body mass index quartile	2,740							
I (lowest)		24.5	15.9	10.4	22.0	14.2	15.0	36.4
II		28.1	17.1	14.0	25.4	17.1	13.3	39.5
III		28.1	15.5	10.5	25.4	14.2	11.9	33.7
IV (highest)		23.6	14.5	10.3	24.9	11.6	13.4	38.9
χ^2		5.4	1.7	6.2	2.6	8.1*	2.5	5.9
Current smoking	2,822							
No		25.3	14.4	8.9	22.7	12.1	12.5	34.4
Yes		29.2	18.0	14.9	27.9	18.5	15.5	41.9
χ^2		4.6*	5.7**	21.0***	8.3**	19.6**	5.3*	15.0***
Alcohol frequency	2,782							
None		25.5	13.5	10.5	23.8	13.2	11.4	36.8
Light (1 day/wk)		27.5	16.6	13.9	24.8	13.7	13.6	40.4
Moderate (2-4 days/wk)		27.0	19.4	10.3	24.3	15.7	16.5	35.7
Heavy (5-7 days/wk)		30.0	19.5	14.4	33.6	19.0	14.8	39.5
χ^2		1.7	12.8**	6.0	5.7	4.7	9.9*	3.2
Exercise	846							
Light (<3x/wk)		30.3	17.6	11.9	27.2	15.2	16.9	38.2
Moderate (3-4x/wk)		29.7	17.6	11.9	25.9	14.9	12.1	38.0
Heavy (5-7x/wk)		27.3	16.0	18.0	23.5	16.7	18.8	39.3
χ^2		0.6	0.3	4.6	0.7	0.4	4.7	0.1

*$p < 0.05$
**$p < 0.01$
***$p < 0.001$

Table 4. Logistic regression examining association of behavioral and life style covariates with menstrual symptoms adjusted for age, race, and paygrade, U.S. Navy Women Aboard Ship Study, 15 NOV 1994 - 31 DEC 1996.

Symptom:	Cramps or pain		Bleeding between periods		Excessive frequency		Heavy periods		Periods ≥ 1 week		Scanty flow		Irregular periods	
	OR	CI	OR	CI	OR	CI	OR	CI	OR	CI	OR	CI	OR	CI
Age per year	.98	(.96, 1.00)	.95[c]	(.93, .98)	.99	(.96, 1.02)	1.00	(.98, 1.03)	.96[b]	(.93, .99)	.97	(.95, 1.00)	.98[a]	(.96, .99)
Race														
White	1.00		1.00		1.00		1.00		1.00		1.00		1.00	
Black	1.05	(.90, 1.21)	1.11	(.94, 1.32)	.88	(.71, 1.08)	1.08	(.93, 1.26)	1.03	(.85, 1.23)	.93	(.76, 1.15)	.87[a]	(.76, .99)
Other	1.01	(.82, 1.23)	1.08	(.86, 1.36)	1.12	(.86, 1.47)	.97	(.80, 1.48)	.98	(.76, 1.26)	.85	(.64, 1.14)	1.05	(.89, 1.25)
Paygrade														
Enlisted, E1-E4	1.00		1.00		1.00		1.00		1.00		1.00		1.00	
Enlisted, E5-E9	1.11	(.90, 1.37)	1.11	(.86, 1.42)	1.22	(.86, 1.74)	1.10	(.88, 1.37)	1.39[a]	(1.01, 1.90)	.98	(.76, 1.26)	1.29[b]	(1.06, 1.58)
Officer	.72[a]	(.53, .99)	.96	(.67, 1.36)	.52[a]	(.40, .69)	.65	(.46, .91)	.51[b]	(.30, .86)	1.14	(.82, 1.59)	.50[c]	(.37, .69)
BMI (Kg/m^2)	1.00	(.48, 2.10)	.49	(.96, 1.02)	.99	(.95, 1.03)	1.01	(.98, 1.04)	.96[a]	(.92, .99)	.99	(.95, 1.03)	1.00	(.97, 1.03)
Body mass index quartile														
I (lowest)	1.00		1.00		1.00		1.00		1.00		1.00		1.00	
II	1.11	(.95, 1.29)	1.10	(.83, 1.31)	1.29[b]	(1.05, 1.57)	1.01	(.91, 1.25)	1.25[a]	(1.03, 1.50)	.98	(.80, 1.20)	1.09	(.95, 1.26)
III	1.12	(.96, 1.30)	.99	(.82, 1.20)	.93	(.75, 1.16)	1.05	(.90, 1.23)	1.00	(.83, 1.21)	.88	(.71, 1.08)	.87[a]	(.75, .99)
IV (highest)	.88	(.75, 1.03)	.91	(.75, 1.33)	.92	(.74, 1.14)	1.01	(.86, 1.17)	.80	(.65, .98)	1.03	(.84, 1.26)	1.10	(.96, 1.27)
Current smoking														
No	1.00		1.00		1.00		1.00		1.00		1.00		1.00	
Yes	1.13[b]	(1.03, 1.25)	1.22[c]	(1.09, 1.38)	1.33[c]	(1.17, 1.51)	1.17[c]	(1.06, 1.29)	1.31[c]	(1.16, 1.48)	1.13[a]	(1.01, 1.29)	1.14[b]	(1.05,1.24)
Alcohol frequency														
None	1.00		1.00		1.00		1.00		1.00		1.00		1.00	
Light	1.01	(.84, 1.22)	.96	(.74, 1.25)	1.14	(.90, 1.46)	.93	(.77, 1.13)	.88	(.70, 1.11)	.96	(.75, 1.22)	1.09	(.92, 1.28)
Moderate	.99	(.83, 1.18)	1.20	(.98, 1.46)	.84	(.66, 1.53)	.91	(.76, 1.07)	1.06	(.86, 1.30)	1.20	(.96, 1.50)	.91	(.78, 1.07)
Heavy	1.14	(.84, 1.54)	1.22	(.85, 1.75)	1.23	(.86, 1.52)	1.40[a]	(1.05, 1.89)	1.32	(.92, 1.88)	1.07	(.71, 1.62)	1.06	(.80, 1.41)
Exercise frequency														
Light	1.00		1.00		1.00		1.00		1.00		1.00		1.00	
Moderate	1.05	(.84, 1.31)	1.04	(.80, 1.35)	.85	(.74, 1.15)	1.02	(.81, 1.29)	.96	(.73, 1.27)	.76	(.57, 1.01)	1.01	(.84, 1.23)
Heavy	.91	(.71, 1.15)	.94	(.70, 1.25)	1.39[a]	(1.03, 1.87)	.90	(.70, 1.16)	1.09	(.82, 1.46)	1.22	(.90, 1.65)	1.02	(.83, 1.26)

Abbreviations: OR = odds ratio; CI = 95% confidence interval; BMI = body mass index
a $p < 0.05$
b $p < 0.01$
c $p < 0.001$

REPORT DOCUMENTATION PAGE

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE & DATE OVERED
	1997	Final

4. TITLE AND SUBTITLE
The Association of Life Style Factors with Menstrual Symptoms in Women Serving Aboard U.S. Navy Ships

5. FUNDING NUMBERS
Program Element:
Work Unit Number:
Army Reimb MIPR OPKM6654
Army Reimb- 6611
63706N M0095.001- 6707

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8. PERFORMING ORGANIZATION
.
Report No. 97-24

9. SPONSORING/MONITORING AGENCY NAMES(S) AND ADDRESS(ES)
Naval Medical Research and Development Command
National Naval Medical Center
Building 1, Tower 2
Bethesda, MD 20889-5044

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE
A

13. ABSTRACT ***(Maximum 200 words)***

It has been estimated that 50-85% of women in the United States currently having menstrual periods experience dysmenorrhea and other menstrual or premenstrual symptoms, and that 3.5-7 million are incapacitated for one to two days each month because of these symptoms. Previous studies examining the association of behavioral and life style factors such as obesity, cigarette smoking, alcohol consumption and exercise with menstrual symptoms have yielded inconsistent results, with some showing positive association and others showing either no association or a negative association. Because these life style factors are all potentially modifiable, the demonstration and elucidation of their association with menstrual symptoms represents an important avenue of research. Most previous studies of the association of life style variables with menstrual disorders have relied on small clinic- or physician-based samples of women, or small samples of college students. There have been relatively few large, population-based studies of the association of behavioral and life style variables with dysmenorrhea or other menstrual symptoms.

Results suggested that interventions targeted at smoking cessation might be useful to reduce the prevalence of menstrual symptoms, cycle disorders and time lost from work.

14. SUBJECT TERMS
dysmenorrhea and other menstrual or premenstrual symptoms
lifestyle factors
smoking cessation

15. NUMBER OF PAGES
15

16. PRICE CODE

17. SECURITY CLASSIFI-CATION OF REPORT	18. SECURITY CLASSIFI-CATION OF THIS PAGE	19. SECURITY CLASSIFI-CATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	Unclassified